(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 655 071 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.05.2006 Bulletin 2006/19

(51) Int Cl.:
B01L 9/06 *(2006.01)* ***G01N 35/04*** *(2006.01)*

(21) Application number: **04078041.3**

(22) Date of filing: **04.11.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL HR LT LV MK YU

(71) Applicants:
- **F. HOFFMANN-LA ROCHE AG**
  4070 Basel (CH)
- **Roche Diagniostics GMBH**
  68305 Mannheim (DE)
  Designated Contracting States:
  DE

(72) Inventors:
- **Meyer, Thomas**
  6330 Cham (CH)
- **Schlaubitz, Thomas**
  6045 Meggen (CH)
- **Schorno, Reto**
  6043 Adligenswil (CH)

(74) Representative: **Ventocilla, Abraham et al**
Ventocilla Patent AG
Burgstrasse 8
4107 Ettingen (CH)

(54) Test tube stand with a movable section for shaking the sample.

(57) A rack (11) for holding containers containing liquids used in clinical chemistry analyzers. The rack comprises

(a) a frame (12) having two or more sections, each section (13, 14) being adapted for receiving a liquid containing component,
at least one of the sections (13) of said frame (12) being adapted for receiving a first liquid containing component which is adapted for being removably but tightly mechanically connected to said frame,

(b) at least one movable part (21) adapted to be removably coupled to a shaker device, said movable part being adapted for receiving and holding a second liquid containing component,
at least one of the sections (14) of said frame being adapted for receiving said movable part (21) and allowing motion of said movable part (21) within predetermined limits.

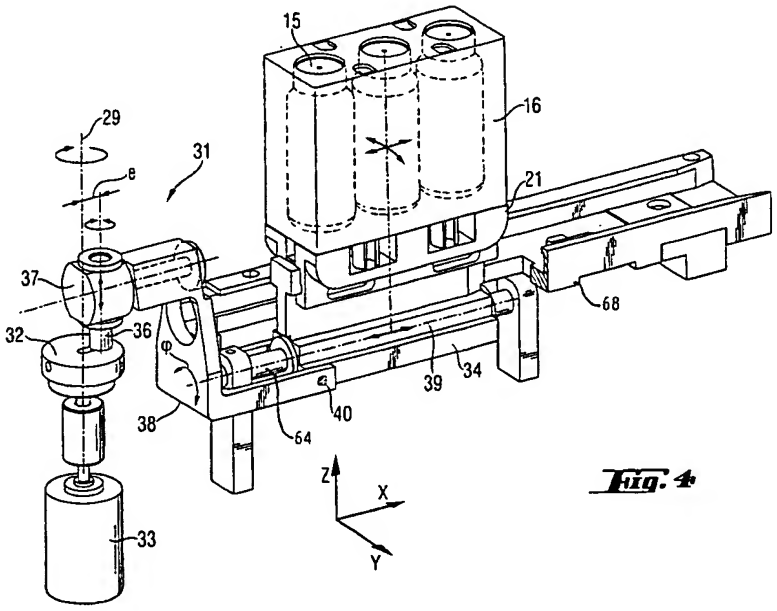


Fig. 4

EP 1 655 071 A1

Description

[0001] The invention concerns a rack for holding containers containing liquids used in clinical chemistry analyzers.

[0002] The invention further concerns an automatic analyzer for analyzing biological samples by means of a clinical chemistry method.

[0003] In automatic clinical chemistry analyzers racks are used for holding containers of liquids required for performing analysis of samples to be analyzed. Some of those liquids are e.g. solutions containing magnetic particles which should be uniformly distributed in the solution; such liquids require agitation during predetermined time intervals, whereas other required liquids require no agitation at all.

[0004] In prior art apparatuses it has therefore been necessary to have additional racks for containers which contain liquids that require agitation and agitating means connectable to such racks or to selectively transport such containers to a station for agitating liquid containers and thereby the liquids contained therein. A disadvantage of both approaches is that they increase the complexity and the manufacturing cost of automatic clinical chemistry analyzers. It is therefore desirable to have racks and analyzers which do not have this disadvantage.

[0005] A first aim of the invention is therefore to provide a rack which makes it possible to eliminate the above mentioned disadvantage.

[0006] A second aim of the invention is to provide an analyzer which makes it possible to eliminate the above mentioned disadvantage.

[0007] According to a first aspect of the invention the above mentioned first aim is achieved with a rack having the features defined by claim 1.

[0008] According to the intended use of the rack defined by claim 1, a container containing a liquid which has to be agitated is placed on a movable part of the rack which is adapted to be shaken by means of a shaker mechanism.

[0009] According to a second aspect of the invention the above mentioned second aim is achieved with an analyzer having the features defined by claim 6.

[0010] There is also a need for an analyzer having a low cost shaker device which is suitable for agitating liquids e.g. reagents contained in reagent containers located in a rack used in automatic clinical chemistry analyzers. An example of such liquid reagents are those containing magnetic particles which should be agitated in order that the magnetic particles are homogeneously distributed in the liquid.

[0011] A third aim of the invention is therefore to provide an analyzer having a low cost shaker device which is useful for the purpose just mentioned.

[0012] According to a third aspect of the invention the above mentioned third aim is achieved with an analyzer having the features defined by claim 10.

[0013] Preferred embodiments are defined by subclaims attached to this specification.

[0014] The subject invention will now be described in terms of its preferred embodiments with reference to the accompanying drawings. These embodiments are set forth to aid the understanding of the invention, but are not to be construed as limiting.

[0015] Fig. 1 shows a perspective view of a rack 11 according to the invention

[0016] Fig. 2 shows an exploded view of rack 11 shown by Fig. 1, removable part 21 of rack 11 and a casing 16 containing several containers 15 which each contain a liquid to be agitated.

[0017] Fig. 3 shows a perspective view of a part of an analyzer according to the invention.

[0018] Fig. 4 shows a perspective view of a first embodiment of a shaker device 31 which is part of the analyzer shown by Fig. 3.

[0019] Fig. 5 shows a partial cross-sectional view of means for coupling movable part 21 of rack 11 with a carriage 34 of a shaker device 31 by means of a leaf spring 35.

[0020] Fig. 6 shows a partial cross-sectional view of a movable part 21 of rack 11 coupled with carriage 34 of shaker device 31 by means of leaf spring 35.

[0021] Fig. 7 shows curves representing the variation with time of the components of motion of carriage 34 in three orthogonal directions X, Y, Z and of an angular component φ corresponding to the oscillation of the carrier around an axis of oscillation.

[0022] Fig. 8 shows a path M of a point of casing 16 when it is moved by shaker device 31 shown by Fig. 4.

[0023] Fig. 9 shows a perspective partial view of a second embodiment of an analyzer according to the invention.

[0024] Fig. 10 shows an enlarged view of a portion of Fig. 9.

[0025] Fig. 11 shows a perspective partial view of a third embodiment of an analyzer according to the invention.

[0026] Fig. 12 shows an enlarged view of a portion of Fig. 11.

[0027] Fig. 13 shows a perspective partial view of a fourth embodiment of an analyzer according to the invention.

[0028] Fig. 14 shows an enlarged view of a portion of Fig. 13.

REFERENCE NUMERALS IN DRAWINGS

[0029]

11 rack
11a rack
12 frame
13 section of frame 12
14 section of frame 12
15 liquid container
16 liquid container carrier (e.g. a kit of reagents)

21 movable part of rack 11
28 encoder
29 axis of rotation of motor shaft 71
31 shaker device
32 disk driven by motor 33
33 step motor
34 carriage of shaker device 31
35 leaf spring
36 eccentric pin
37 cylindrical joint combined with a revolute joint
38 connection piece
39 axis of oscillation and deviation
40 joint
41 pin
42 pin
43 pin
51 opening of removable part 21
52 opening of removable part 21
53 slide bearing
61 motor shaft
61a eccentric pin
61b axis of eccentric pin
62 slide bearing
63 carriage of shaker device
64 guiding shaft
65 ball and socket joint
66 electro-optical detector
67 shaker device
68 support plate for the frame 12 of rack 11
70 shaker device
71 motor shaft
71a eccentric pin
71b axis of eccentric pin
72 slide bearing
73 motor holder
74 guiding shaft
75 guiding shaft
76 machine frame
77 guiding support member
78 ball and socket joint
79 movable support plate for the frame 12 of rack 11a
80 shaker device
81 motor shaft
81a eccentric pin
81b axis of eccentric pin
82 slide bearing
83 motor holder
84 guiding shaft
85 guiding shaft
86 machine frame
87 arm
88 ball and socket joint
89 movable support plate

e eccentricity
ϕ deviation angle
S arrow for longitudinal movement
R arrow for rotation

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0030] An automatic clinical chemistry analyzer comprises in general means for handling liquids like biological samples or reagents and means for analyzing sample-reagent-mixtures. A reagent can be e.g. a liquid containing magnetic particles.

[0031] In the following description only those parts of an automatic clinical chemistry analyzer are described which are necessary to describe how a rack containing liquid containers or a movable part of such a rack is agitated by means of a shaker device.

EXAMPLE OF A RACK ACCORDING TO THE INVENTION

[0032] Fig. 1 shows a rack 11 according to the invention. Rack 11 has a frame 12 and a movable part 21. Frame 12 has at least one section 13 for holding a first liquid containing component which does not have to be agitated and at least one section 14 for holding a second liquid containing component which has to be agitated. The movable part 21 of the rack 11 is located in a section 14. The shape and size of section 14 allows movement of movable part 21 within predetermined limits.

[0033] Rack 11 is made e.g. of a polycarbonate (PC).

[0034] The first and the second liquid containing components are e.g. a single liquid container or a component comprising a casing 16 which contains one or more liquid containers 15. A component of the latter type is described in European Patent Application EP 0564970 A2.

[0035] Fig. 2 shows a rack 11 having a section 14 that holds a liquid containing a component of the type described in European Patent Application EP 0564970 A2. Such a component comprises e.g. a casing 16 wherein one or more containers 15 are lodged. Each of the containers 15 contains a liquid to be agitated.

EXAMPLE OF A FIRST EMBODIMENT OF ANALYZER ACCORDING TO THE INVENTION

[0036] Fig. 3 shows a perspective view of a part of an analyzer according to the invention which includes a rack of the type described above with reference to Figures 1 and 2.

[0037] A first embodiment of a shaker device which is part of this analyzer is described hereinafter with reference to Figures 4 to 8.

[0038] As shown by Fig. 3, the analyzer comprises several electromechanical shaker devices 31 each of which is adapted for being connected to a removable part 21 of rack 11.

[0039] Among the parts of shaker 31 represented in Fig. 3 are a carriage 34 and a disk 32 which carries an eccentric pin 36 and which is driven by a motor 33. Motor 33 is preferably a step motor.

[0040] Fig 4 shows a perspective view of shaker device

31. In Fig. 4 a carriage 34 which is part of shaker mechanism 31 is mechanically coupled to movable part 21 of rack 11.Carriage 34 is connected with a connection piece 38 by means of a joint 40. Connection piece 38 is rotatably connected to a cylindrical joint combined with a revolute joint 37 which is in turn connected with eccentric pin 36. The lower part of carriage 34 includes a slide bearing 53 which allows carriage 34 to slide back and forth along the length axis 39 of a guiding shaft 64 and also to oscillate back and forth around axis 39. Guiding shaft 64 has a fixed position and is parallel to the X-axis.

[0041] Fig. 4 also shows a support plate 68 for the frame 12 of rack 11.

[0042] As shown in Fig. 4, the eccentricity e is the distance that separates the axis of rotation 29 of motor 33 and the length axis of pin 36 from each other.

[0043] Fig. 5 shows a partial cross-sectional view of means for coupling movable part 21 of rack 11 with a carriage 34 of a shaker device 31 by means of a leaf spring 35. As shown by Figures 5 and 6, one end of leaf spring 35 is mechanically connected with movable part 21. Fig. 5 shows a rack 11 in a position at which movable part 21 is not engaged with carriage 34 by means of a leaf spring 35. In Fig. 5, a casing 16 containing liquid containers 15 which do not have to be agitated is mounted on section 13 of rack 11. When frame 12 of rack 11 is in the position represented in Fig. 5 with respect to carriage 34 of shaker device 31, movable part 21 is loosely connected with frame 12. This loose connection is achieved e.g. by means of pins 41, 42, 43 which cooperate with corresponding openings 51, 52 of removable part 21 shown in Fig. 2. Pins 41, 42, 43 are inserted in suitable openings of frame 12.

[0044] Fig. 6 shows a partial cross-sectional view of a movable part 21 of rack 11 coupled with carriage 34 of shaker device 31 by means of leaf spring 35. When frame 12 of rack 11 is in the position represented in Fig. 6 with respect to carriage 34 of shaker device 31, movable part 21 remains connected with frame 12.

[0045] As can be appreciated from Fig. 4, when disk 32 and thereby eccentric pin 36 are rotated by actuation of motor 33, pin 36 and joint 37 cause a movement of connection piece 38 and thereby of carriage 34, movable part 21 and liquid containers 15 in three orthogonal directions X, Y, Z within predetermined limits. Directions X, Y, Z are represented in Fig. 4. This motion is the result of the combination of two movements of connection piece 38: an oscillation of an angle φ around axis 39 and a back and forth motion in X direction.

[0046] The mechanical components of shaker device 31 are made e.g of aluminum or of steel.

[0047] Fig. 7 shows curves representing the variation with time of the components of motion of carriage 34 in three orthogonal directions X, Y, Z and of an angular component φ corresponding to the oscillation of carriage 34 around axis 39.

[0048] Fig. 8 shows a three-dimensional path M of motion of a point of casing 16 when it is moved by shaker device 31 shown by Fig. 4.

[0049] An encoder 28 (not shown in Fig. 4) is connected with motor 33 and is arranged in the housing of motor 33. The angular position of motor 33 is controlled by means of an encoder 28 which for this purpose receives signals from an electro-optical position detector 66 described hereinafter with reference to Figures 9 and 10. Control of the angular position of motor 33 by means of encoder 28 and detector 66 makes it possible to position liquid container carrier 16 and thereby liquid container 16 in a reproducible way, at a predetermined position, e.g. at the end of a shaking operation of shaker device 31.

EXAMPLE OF A SECOND EMBODIMENT OF AN ANALYZER ACCORDING TO THE INVENTION

[0050] The structure of this second analyzer embodiment is similar to the structure of the first embodiment described above, but this second analyzer embodiment comprises a second embodiment of a shaker device which is described hereinafter with reference to Figures 9 and 10.

[0051] Fig. 9 shows a perspective view of a shaker device 67 which is part of an analyzer according to the invention and which serves for moving the movable part 21 of rack 11 and thereby casing 16 in the same way as achieved with shaker 31 and thereby effect the motions represented in Figures 7 and 8.

[0052] Shaker device has a carriage 63 which has the same or similar structure and function as carriage 34 described above with reference to Figures 4-6.

[0053] Shaker device 67 is shown in detail in Fig. 10. Shaker device 67 differs from shaker device 31 represented in Fig. 4 in that it comprises a pin 61a inserted in a ball and socket joint 65 which as shown in Fig. 9 is directly connected to carriage 63 of shaker device 67 and not by means of a joint 37 and a connection piece 38 as is the case when shaker device 31 shown in Fig. 4 is used. Fig. 9 also shows support plate 68 for the frame 12 of rack 11. Pin 61a is driven by a shaft 61 of a step motor 33.

[0054] Fig. 10 also shows the eccentricity e of pin 61a, i.e. the distance e between the length symmetry axis 61 b of pin 61a and the rotation axis 29 of shaft 61 of motor 33.

[0055] The lower part of carriage 63 includes a slide bearing 62 which allows carriage 63 to slide back and forth along the length axis 39 of a guiding shaft 64 and also to oscillate back and forth around axis 39. Guiding shaft 64 has a fixed position and is parallel to the X-axis.

[0056] When motor 33 is actuated, a motion transmitted to carriage 63 by pin 61a and joint 65 moves carriage 63 back and forth along the length axis 39 of guiding shaft 64 and also oscillates carriage 63 back and forth around axis 39.

[0057] Figures 9 and 10 also show an electro-optical position detector 66 which accurately detects the angular position of motor shaft 61. Detector 66 provides signals

to an encoder (not shown in the figures) which serves for accurately positioning motor shaft 61. Control of the angular position of motor shaft 61 by means of the encoder and detector 66 makes it possible to position liquid container carrier 16 and thereby liquid container 16 in a reproducible way, at a predetermined position, e.g. at the end of a shaking operation of shaker device 67.

EXAMPLE OF A THIRD EMBODIMENT OF AN ANALYZER ACCORDING TO THE INVENTION

[0058] Fig. 11 shows a part of a third embodiment of an analyzer according to the invention. This embodiment differs from the above described first and second embodiments in that it does not use the type of rack described above with reference to Figures 1 and 2, but a rack 11a built as a single piece frame 12 having a shape adapted for receiving liquid containers 16.

[0059] As shown by Fig. 11 the third embodiment of the analyzer also comprises a shaker device 70 which has a similar structure as shaker device 67 in Fig. 9. Shaker device 70 comprises a movable support plate 79 adapted for receiving rack 11a. Rack 11a and movable plate 79 are adapted for being removably connectable with each other.

[0060] The lower part of movable plate 79 is formed as a guiding support member 77.

[0061] As shown by Fig. 12 shaker device 70 further comprises an eccentric pin 71a driven by a shaft 71 of a step motor 33.

[0062] Pin 71a is inserted in a ball and socket joint 78 which, as shown in Fig. 12, is directly connected to support member 77 of movable plate 79.

[0063] Fig. 12 also shows the eccentricity e of pin 71a, i.e. the distance e between the length symmetry axis 71b of pin 71a and the rotation axis 29 of shaft 71 of motor 33.

[0064] The lower part of guiding support member 77 includes a slide bearing 72 which allows support member 77 and thereby movable plate 79 to slide back and forth along the length axis 39 of a guiding shaft 75 and also to oscillate back and forth around axis 39. Guiding shaft 75 has a fixed position and is parallel to the X-axis.

[0065] When motor 33 is actuated, a motion transmitted to movable plate 79 by pin 71a and joint 78 moves movable plate 79 back and forth along the length axis 39 of guiding shaft 75 and also oscillates movable plate 79 back and forth around axis 39.

[0066] Shaker device 70 moves rack 11a and thereby casing 16 in the same way as achieved with shaker 31 in the embodiment described with reference to Figures 1-8. Casing 16 in Fig. 11 is thus moved by shaker device 70 as represented in Figures 7 and 8.

[0067] Figures 11 and 12 also show an electro-optical position detector 66 which accurately detects the angular position of motor shaft 71. Detector 66 provides signals to an encoder (not shown in the figures) which serves for accurately positioning motor shaft 71. Control of the angular position of motor shaft 71 by means of the encoder and detector 66 makes it possible to position liquid container carrier 16 and thereby liquid container 16 in a reproducible way, at a predetermined position, e.g. at the end of a shaking operation of shaker device 70.

EXAMPLE OF A FOURTH EMBODIMENT OF AN ANALYZER ACCORDING TO THE INVENTION

[0068] Fig. 13 shows a part of a fourth embodiment of an analyzer according to the invention. This fourth embodiment also uses a rack 11a of the type shown in Fig. 11 and comprises a movable support plate 89 similar to movable plate 79 of the third embodiment.

[0069] This fourth embodiment of an analyzer according to the invention differs from the above described third analyzer embodiment in that it comprises a shaker device 80 which is not connected to the lower and central part of the movable plate, but to one end thereof formed as a bar 87.

[0070] As shown by Fig. 13 shaker device 80 has a similar structure as shaker device 70 in Fig. 11.

[0071] Shaker device 80 comprises a movable support plate 89 adapted for receiving rack 11a. Rack 11a and movable plate 89 are adapted for being removably connectable with each other.

[0072] As shown by Fig. 14 shaker device 80 further comprises an eccentric pin 81a driven by a shaft 81 of a step motor 33.

[0073] Pin 81a is inserted in a ball and socket joint 88 which as shown in Fig. 14 is directly connected to bar 87 at one end of movable plate 89.

[0074] Fig. 14 also shows the eccentricity e of pin 81a, i.e. the distance e between the length symmetry axis 81b of pin 81a and the rotation axis 29 of shaft 81 of motor 33.

[0075] The lower part of movable plate 89 is formed as a guiding support member which includes slide bearings 82 which allow movable plate 89 to slide back and forth along the length axis 39 of guiding shafts 84 and 85 and also to oscillate back and forth around axis 39. Guiding shafts 84 and 85 have a fixed position and are parallel to the X-axis.

[0076] When motor 33 is actuated, motion transmitted to movable plate 89 by pin 81a and joint 88 moves movable plate 89 back and forth along the length axis 39 of guiding shafts 84 and 85 and also oscillates movable plate 89 back and forth around axis 39.

[0077] Shaker device 80 also moves rack 11a and thereby casing 16 in the same way as achieved with shaker 31 in the embodiment described with reference to Figures 1-8. Casing 16 in Fig. 11 is thus moved by shaker device 80 as represented in Figures 7 and 8.

[0078] Figures 13 and 14 also show an electro-optical position detector 66 which accurately detects the angular position of motor shaft 81. Detector 66 provides signals to an encoder (not shown in the figures) which serves for accurately positioning motor shaft 81. Control of the angular position of motor shaft 81 by means of the encoder and detector 66 makes it possible to position liquid con-

tainer carrier 16 and thereby liquid container 16 in a reproducible way, at a predetermined position, e.g. at the end of a shaking operation of shaker device 80.

Claims

1. A rack (11) for holding containers containing liquids used in clinical chemistry analyzers, said rack comprising

   (a) a frame (12) having two or more sections, each section (13, 14) being adapted for receiving a liquid containing component,
   at least one of the sections (13) of said frame (12) being adapted for receiving a first liquid containing component which is adapted for being removably but tightly mechanically connected to said frame,
   (b) at least one movable part (21) adapted to be removably coupled to a shaker device, said movable part being adapted for receiving and holding a second liquid containing component,
   at least one of the sections (14) of said frame being adapted for receiving said movable part (21) and allowing motion of said movable part (21) within predetermined limits.

2. A rack according to claim 1, wherein said at least one movable part (21) is adapted for being positioned within a section (14) of that frame (12) and for being loosely connected with said frame when said movable part (21) is not coupled to said shaker device.

3. A rack according to claim 2, wherein said movable part (21) remains connected with said frame (12) when said movable part (21) is coupled to said shaker device.

4. A rack according to claim 1, wherein said at least one movable part (21) and said second liquid containing component are movable within predetermined limits in three directions (X, Y, Z) which are orthogonal to each other.

5. A rack according to claim 1, wherein said at least one movable part (21) and said second liquid containing component are adapted to be subject to a combined motion comprising an axial displacement along a first axis within predetermined limits and a oscillation around a second axis within predetermined angular limits, said first axis and said second axis being parallel to each other.

6. An automatic analyzer for analyzing biological samples by means of a clinical chemistry method, said analyzer comprising

   (a) a rack (11) for holding containers containing liquids used in clinical chemistry analyzers, said rack comprising

      (a.1) a frame (12) having two or more sections (13, 14), each section being adapted for receiving a liquid containing component, at least one of the sections (13) of said frame being adapted for receiving a first liquid containing component which is adapted for being removably but tightly mechanically connected to said frame,
      (a.2) at least one movable part (21) adapted to be removably coupled to a shaker device (31), said movable part (21) being adapted for receiving and holding a second liquid containing component, and

   (b) an electromechanical shaker device (31) for shaking said at least one movable part (21) of said rack, said shaker device (31) and said movable part (21) being adapted to be removably connected with each other.

7. An automatic analyzer according to claim 6, wherein said shaker device (31) comprises

   (a) an eccentric pin (36) driven by a motor (33), and
   (b) mechanical means (37, 38, 34) which are connected to said pin (36) and which are connectable to said at least one movable part (21) for moving said movable part (21) when said eccentric pin (36) is rotated by said motor.

8. An automatic analyzer according to claim 7, wherein said movable part (21) is subject to a combined motion in three directions (X, Y, Z) which are orthogonal to each other when said pin (36) is rotated by said motor.

9. An automatic analyzer according to claim 7, wherein said movable part (21) is subject to a combined motion comprising an axial displacement along an axis (39) within predetermined limits and a oscillation about said axis (39) within predetermined angular limits when said eccentric pin (36) is rotated by said motor (33).

10. An automatic analyzer for analyzing biological samples by means of a clinical chemistry method, said analyzer comprising

    (a) a rack (11a) for holding containers (16) containing liquids used in clinical chemistry analyzers, and
    (b) an electromechanical shaker device (70, 80) for shaking said rack, said shaker device (70,

80) having a movable plate (79, 89) adapted for receiving said rack (11a) , said rack (11a) and said movable plate (79, 89) being removably connectable with each other,

said shaker device (70, 80) further comprising

(a) an eccentric pin (71a, 81a) driven by a motor (33), and
(b) mechanical means which connect said eccentric pin (71a, 81a) with said movable plate (79, 89).

11. An automatic analyzer according to claim 12, wherein said shaker device (70) comprises a joint (78) which is adapted to receive said eccentric pin (71a), said joint (78) being connected to the bottom part of a guiding support member (77) which is part of or connected with said movable plate (79).

12. An automatic analyzer according to claim 12, wherein said shaker device (80) comprises a joint (88) which is adapted to receive said eccentric pin (81a), said joint (88) being connected to a bar (87) which is an end part of said movable plate (89), said end part being located at one end of said plate along the length axis thereof.

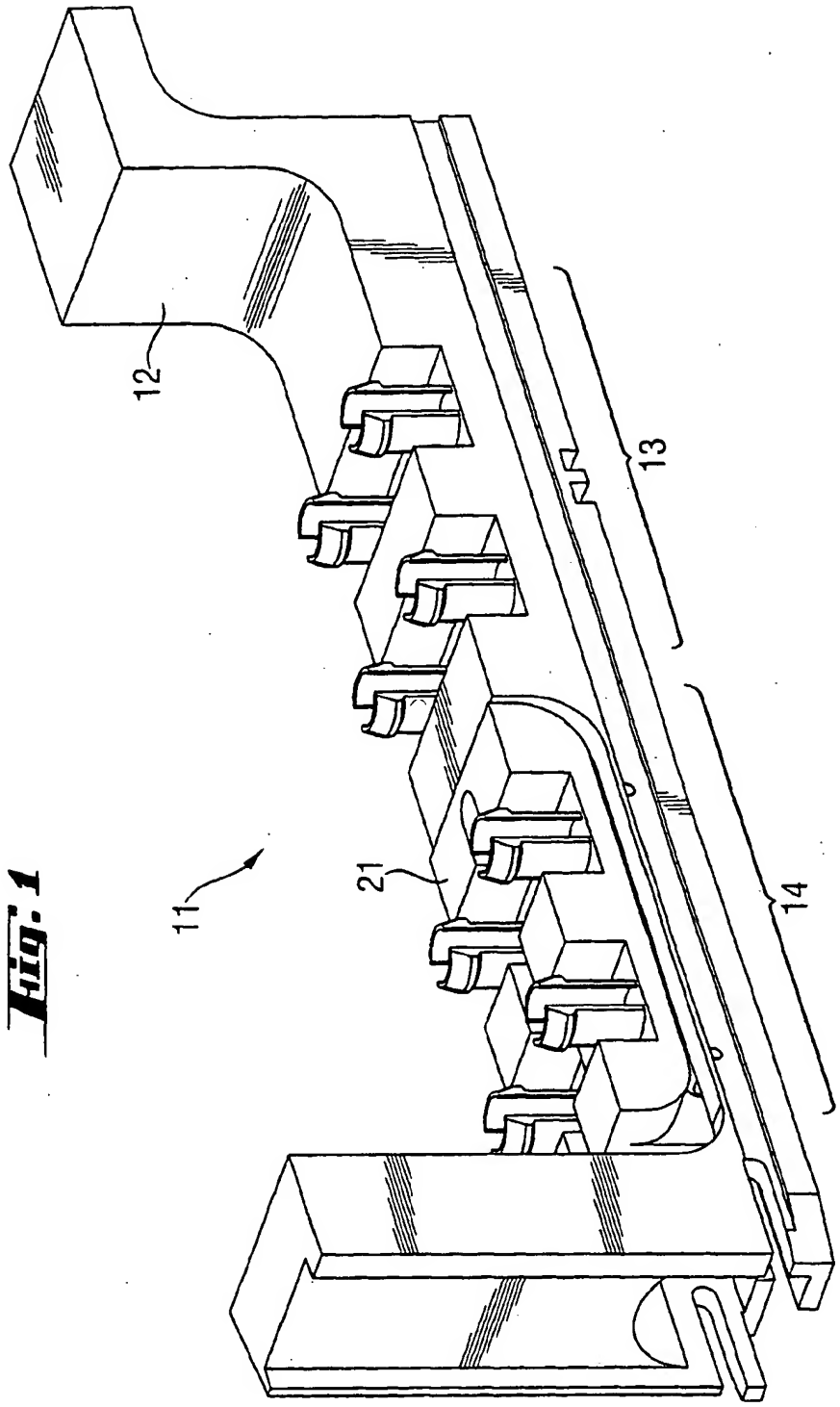


Fig. 1

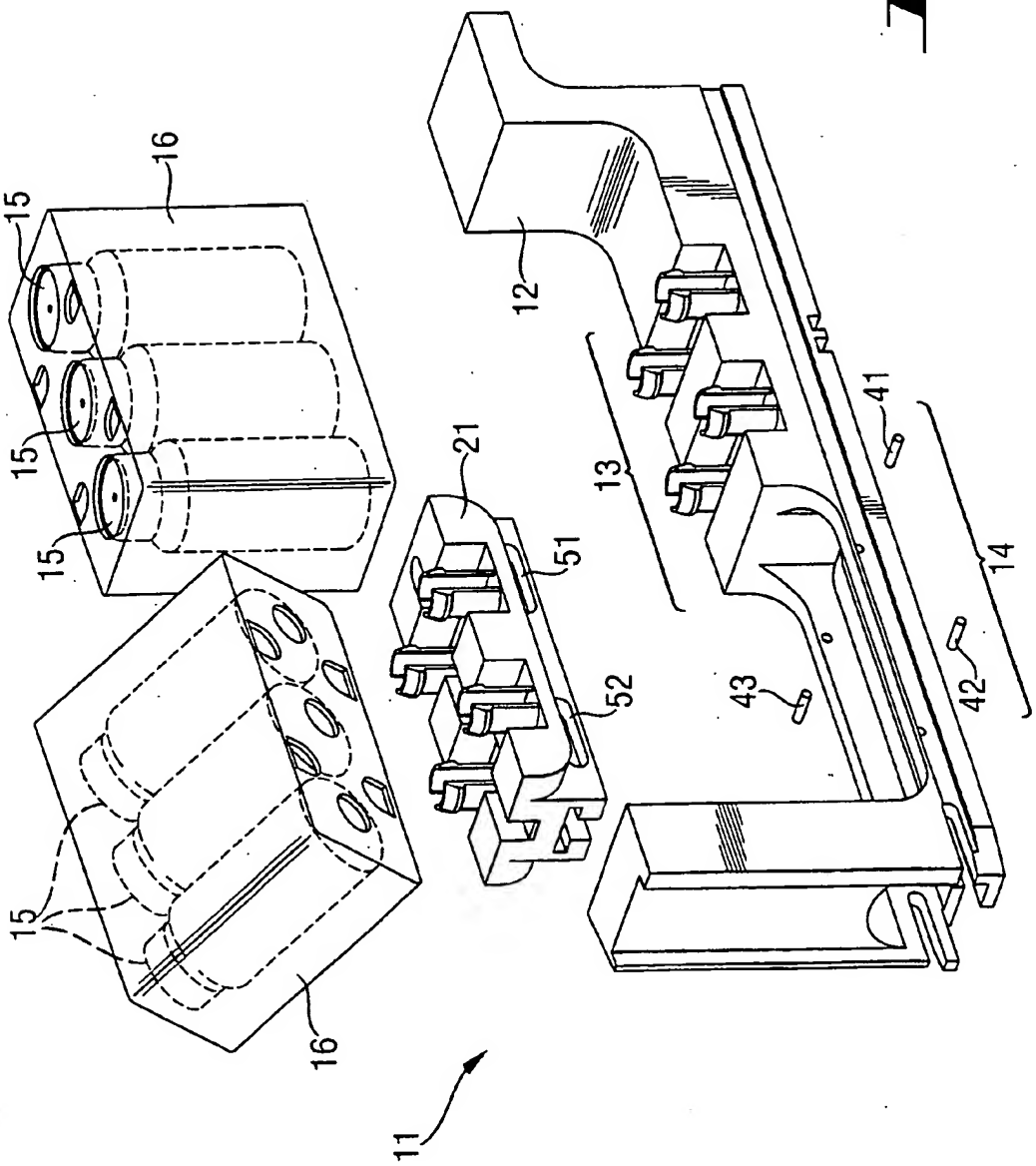


Fig. 2

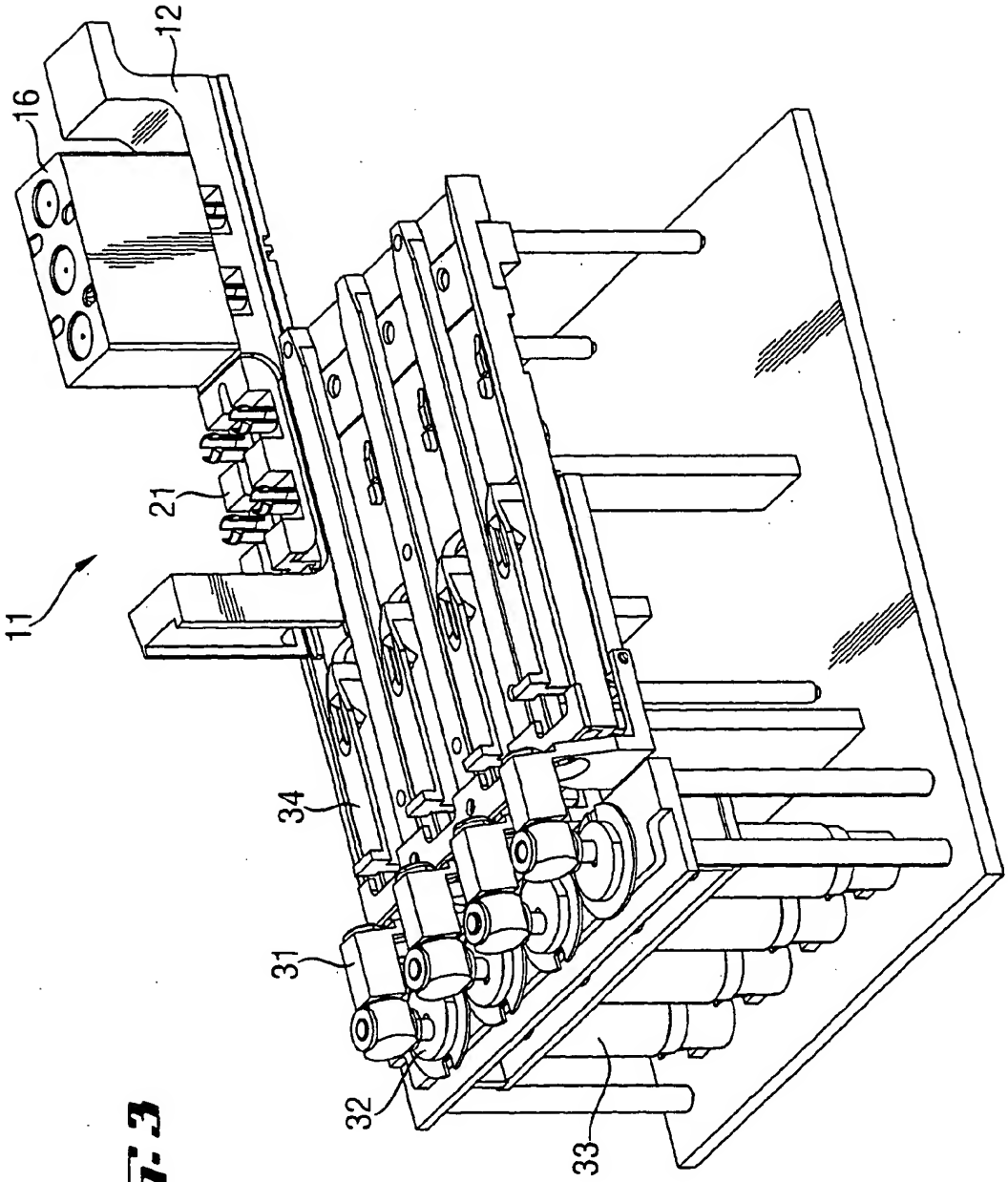


Fig. 3

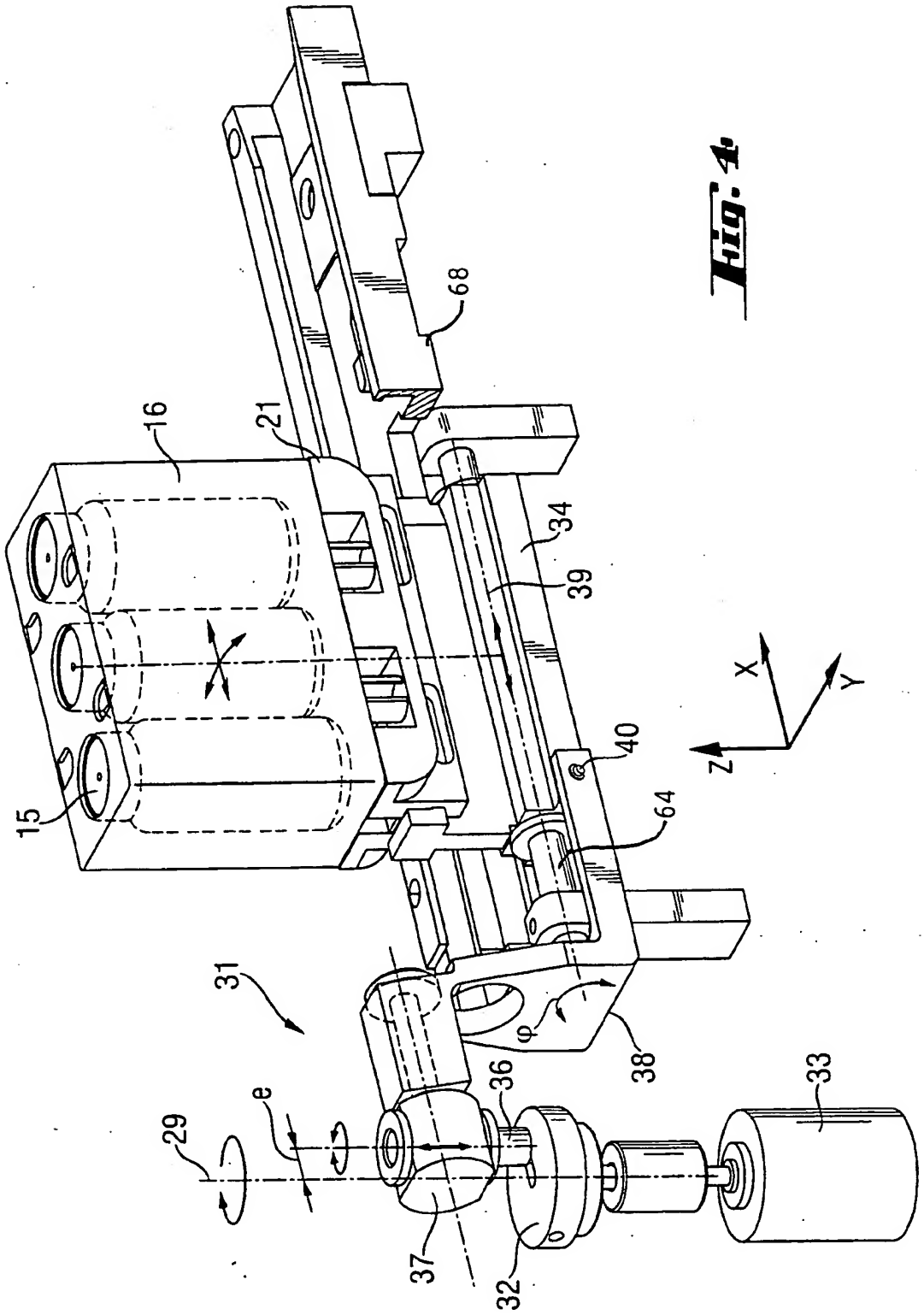


Fig. 4

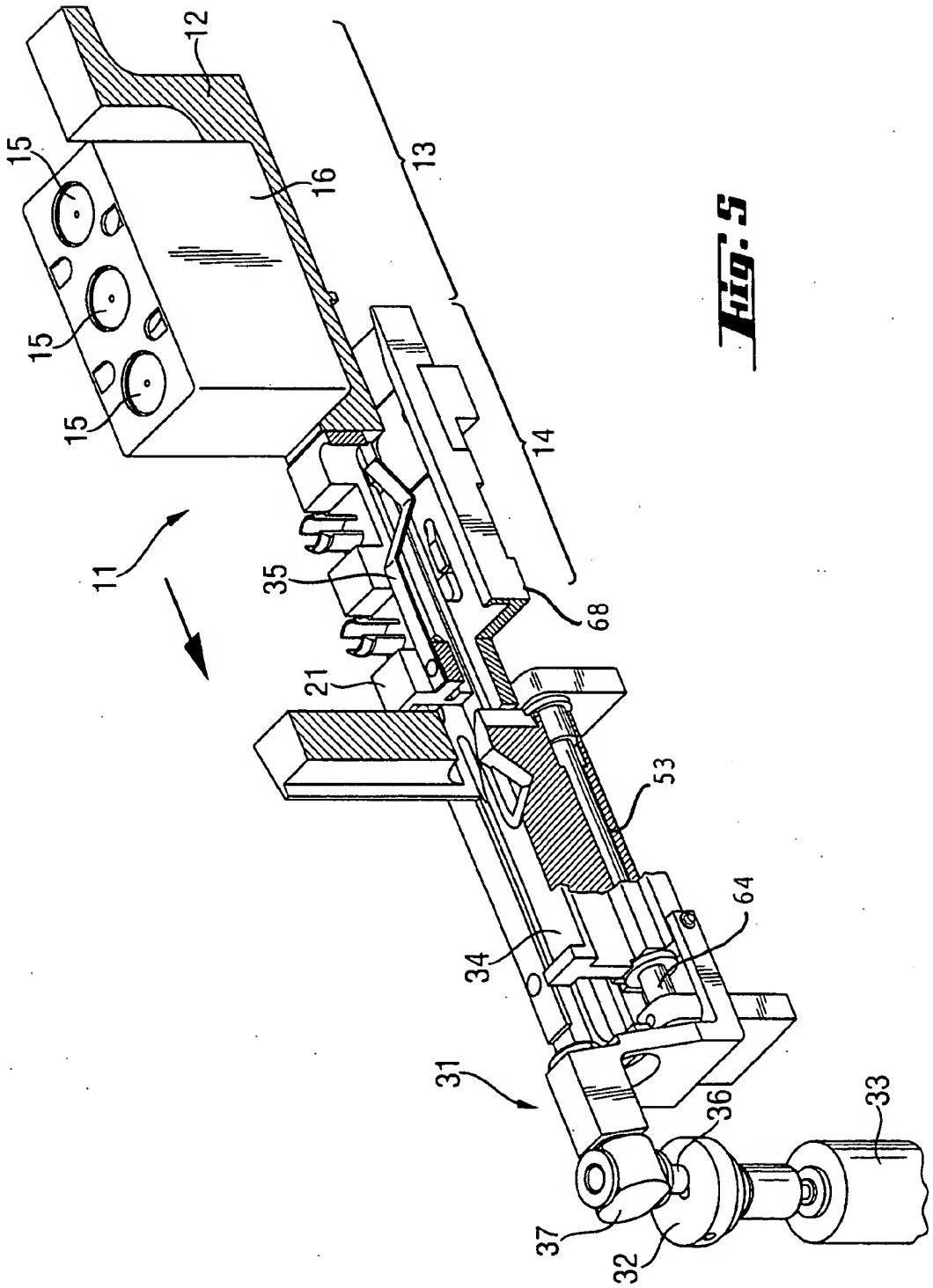


Fig. 5

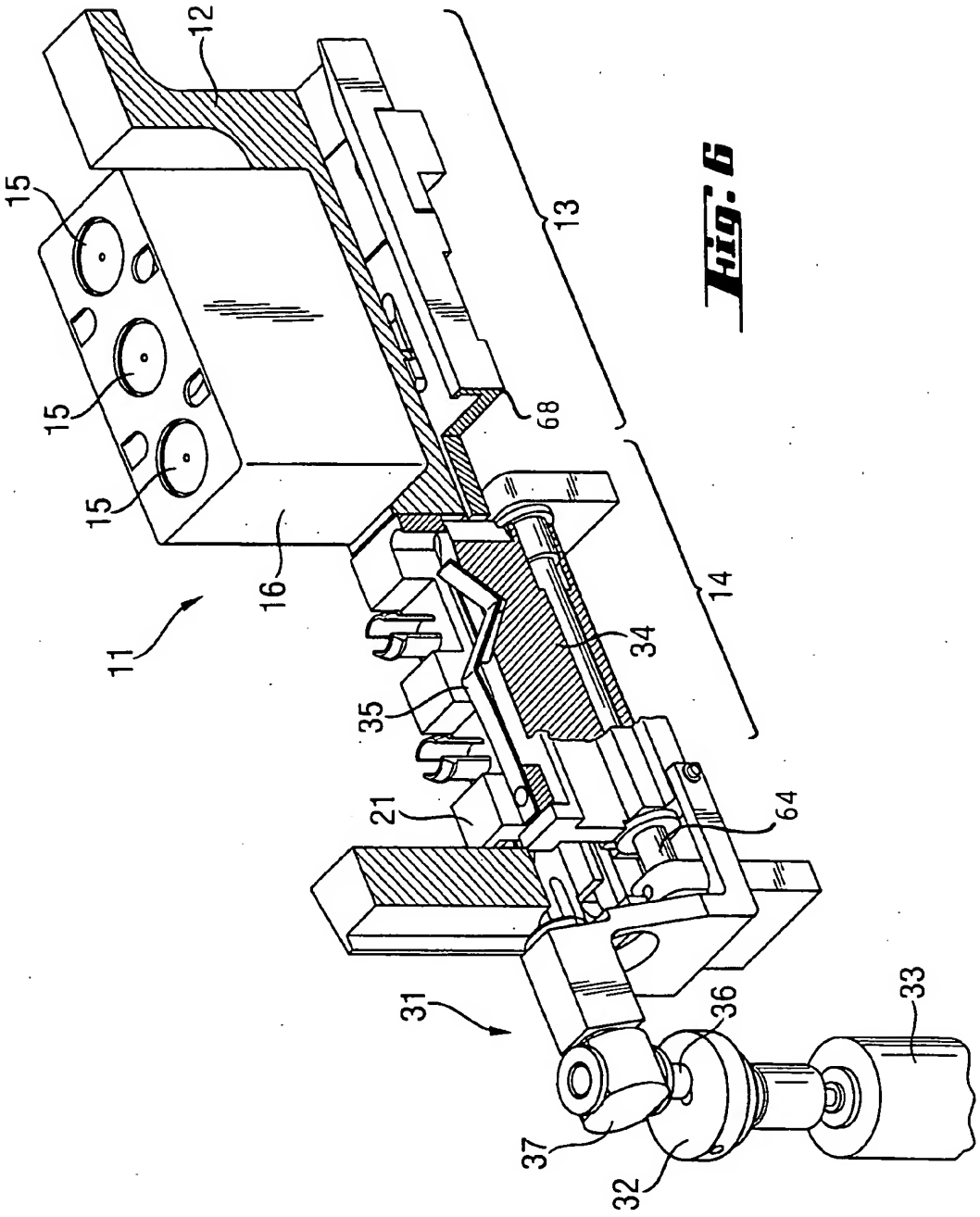


Fig. 6

Fig. 1

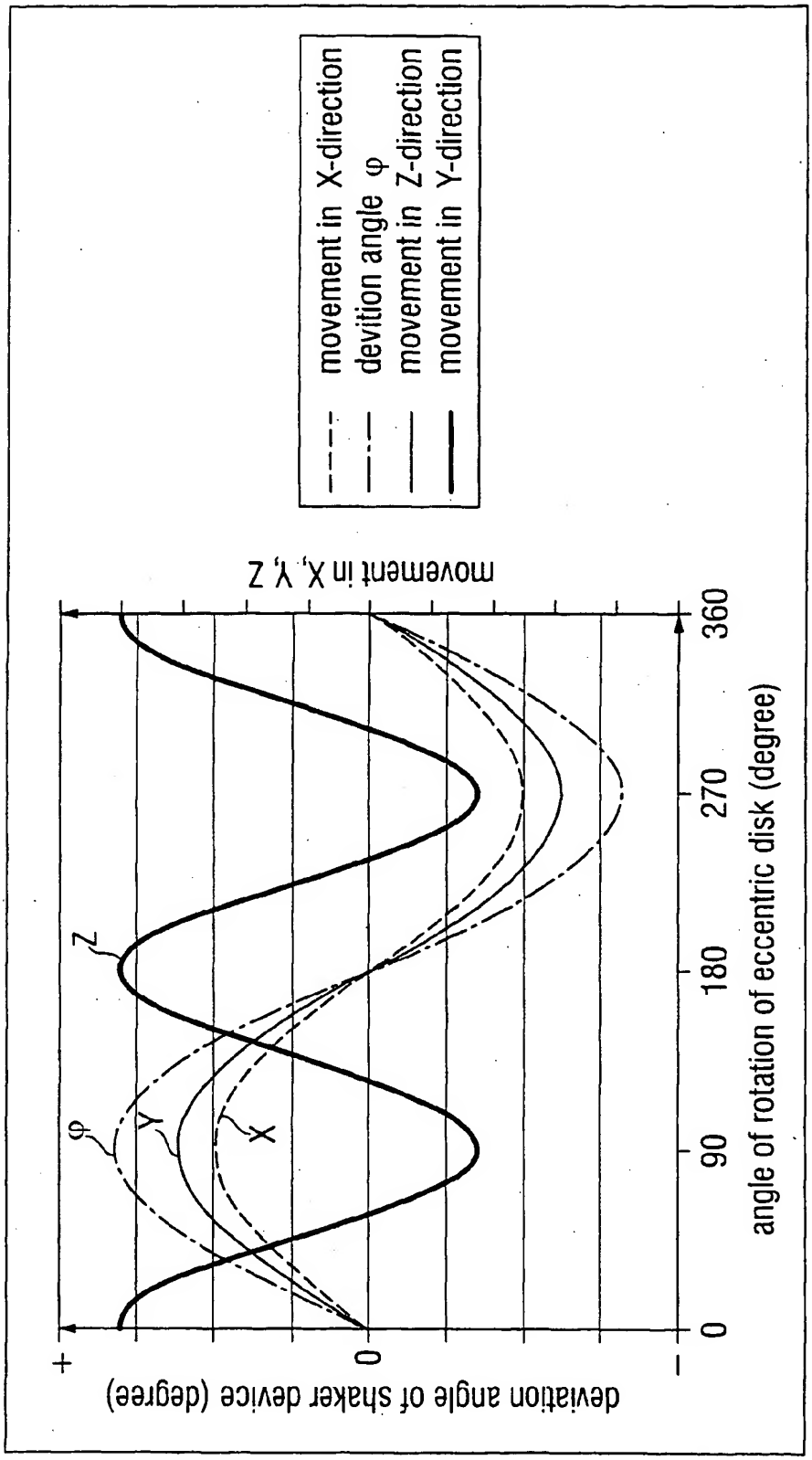
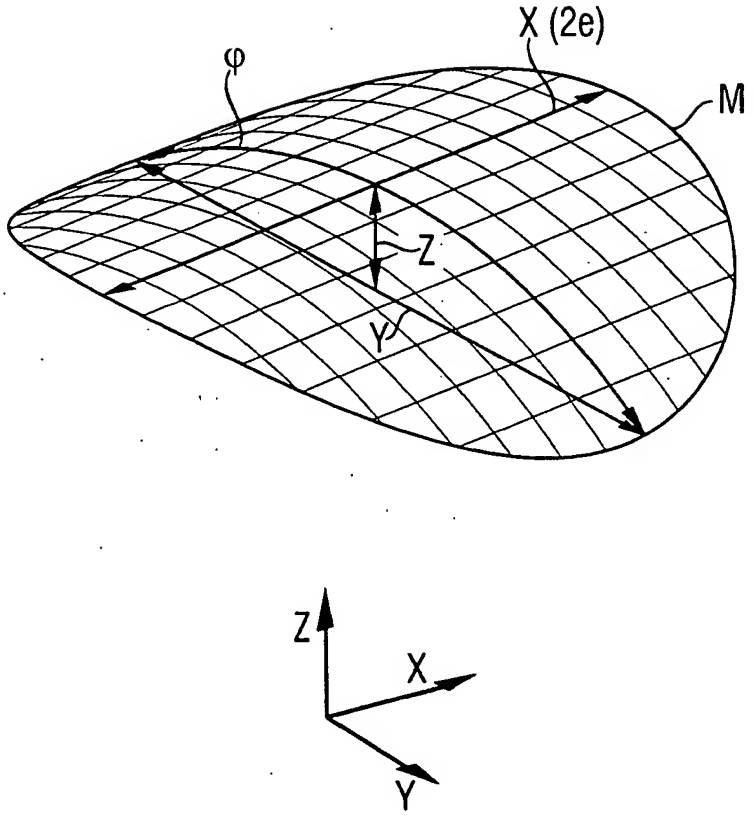

movement in X-direction
devition angle φ
movement in Z-direction
movement in Y-direction
movement in X, Y, Z
deviation angle of shaker device (degree)
angle of rotation of eccentric disk (degree)
0
90
180
270
360
+
0
−
φ
Y
X
Z

Fig. 8



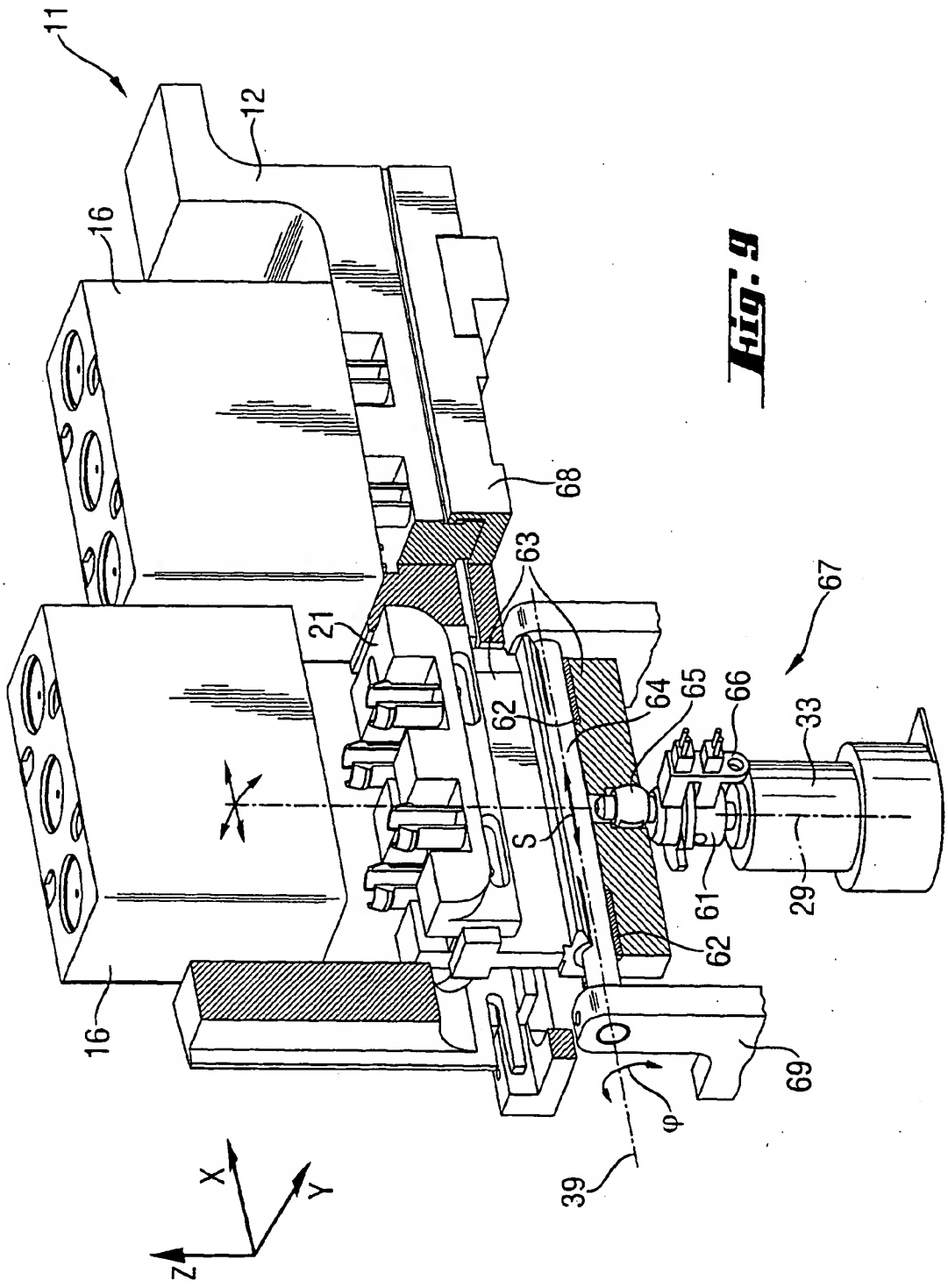


Fig. 9

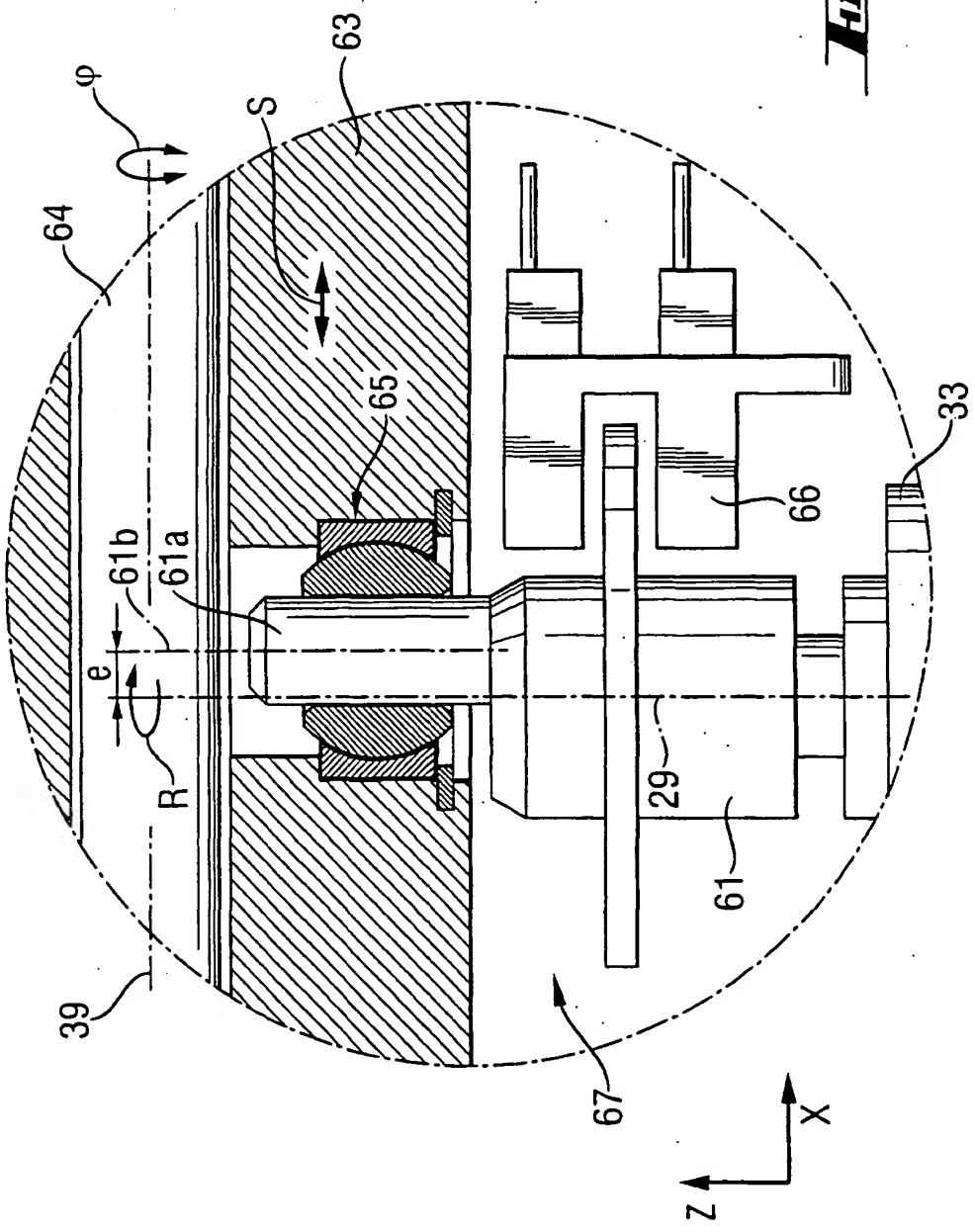


Fig. 10

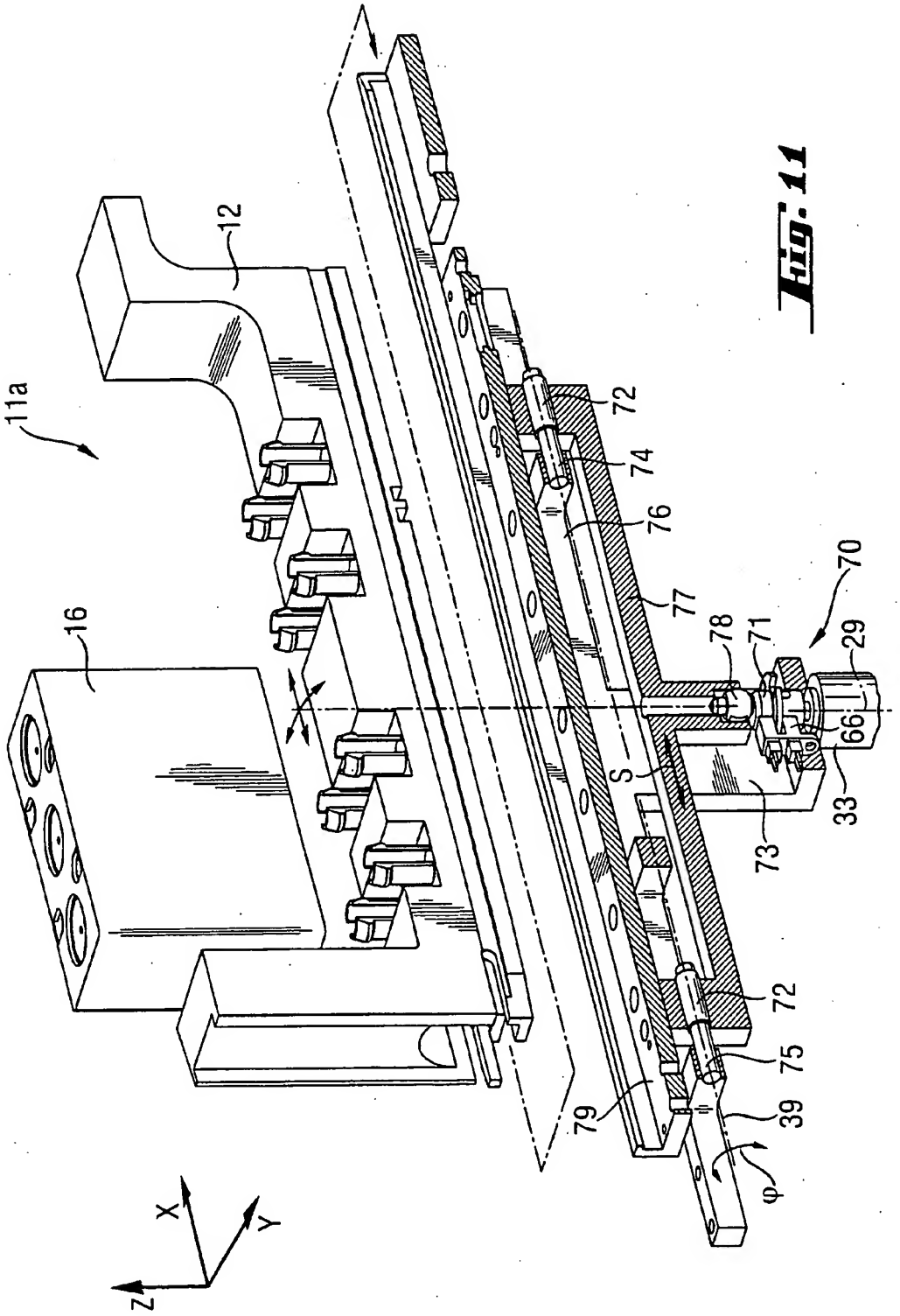


Fig. 11

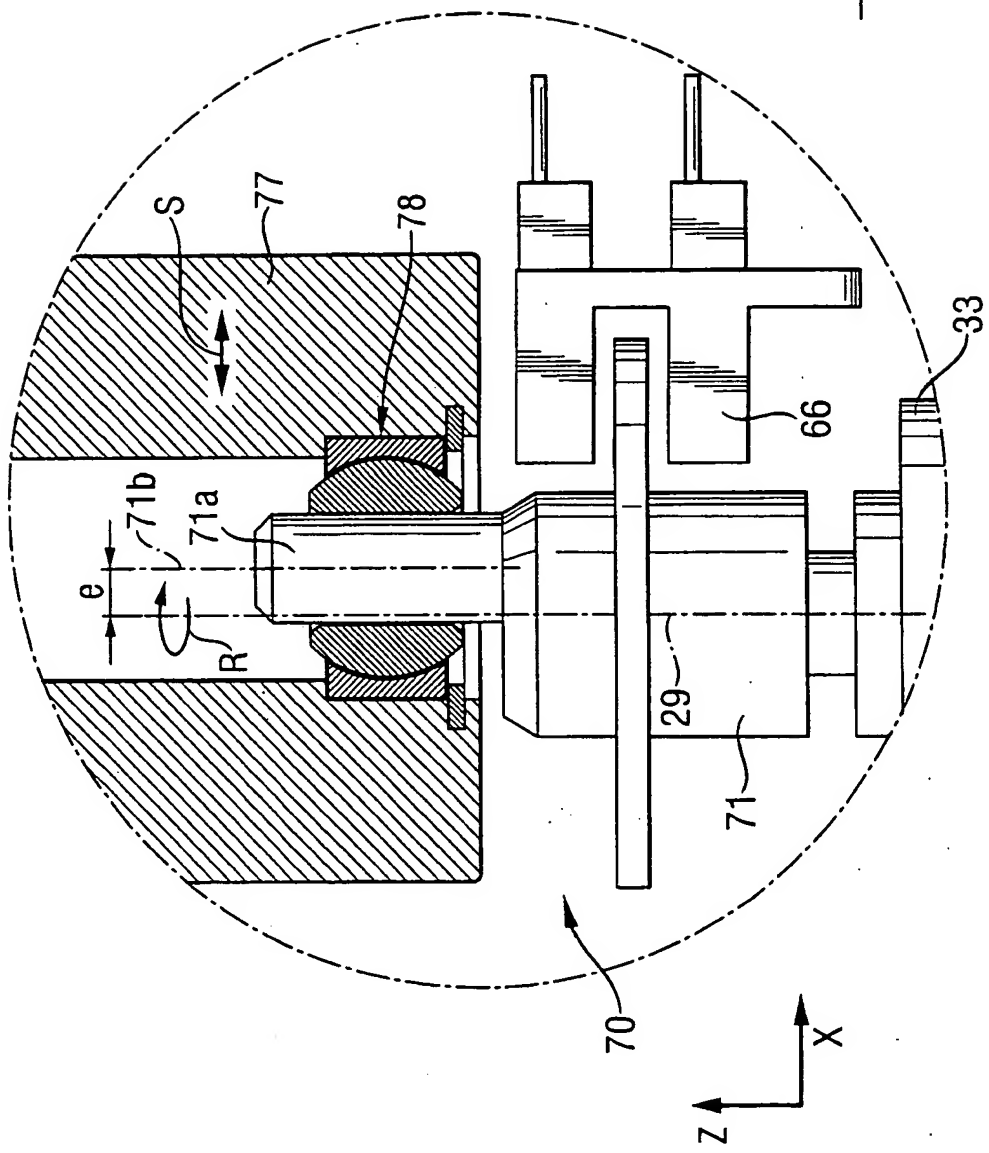


Fig. 12

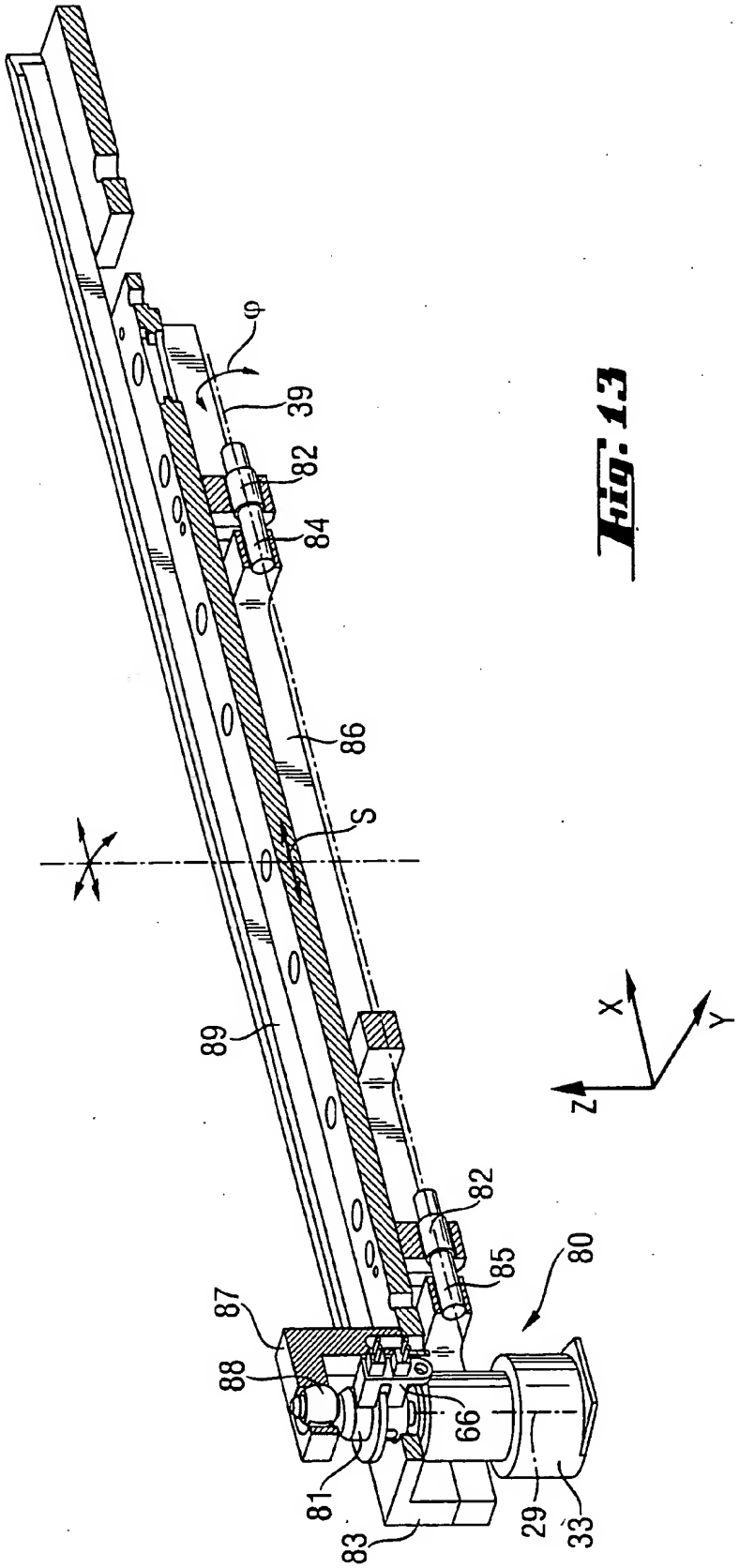


Fig. 13

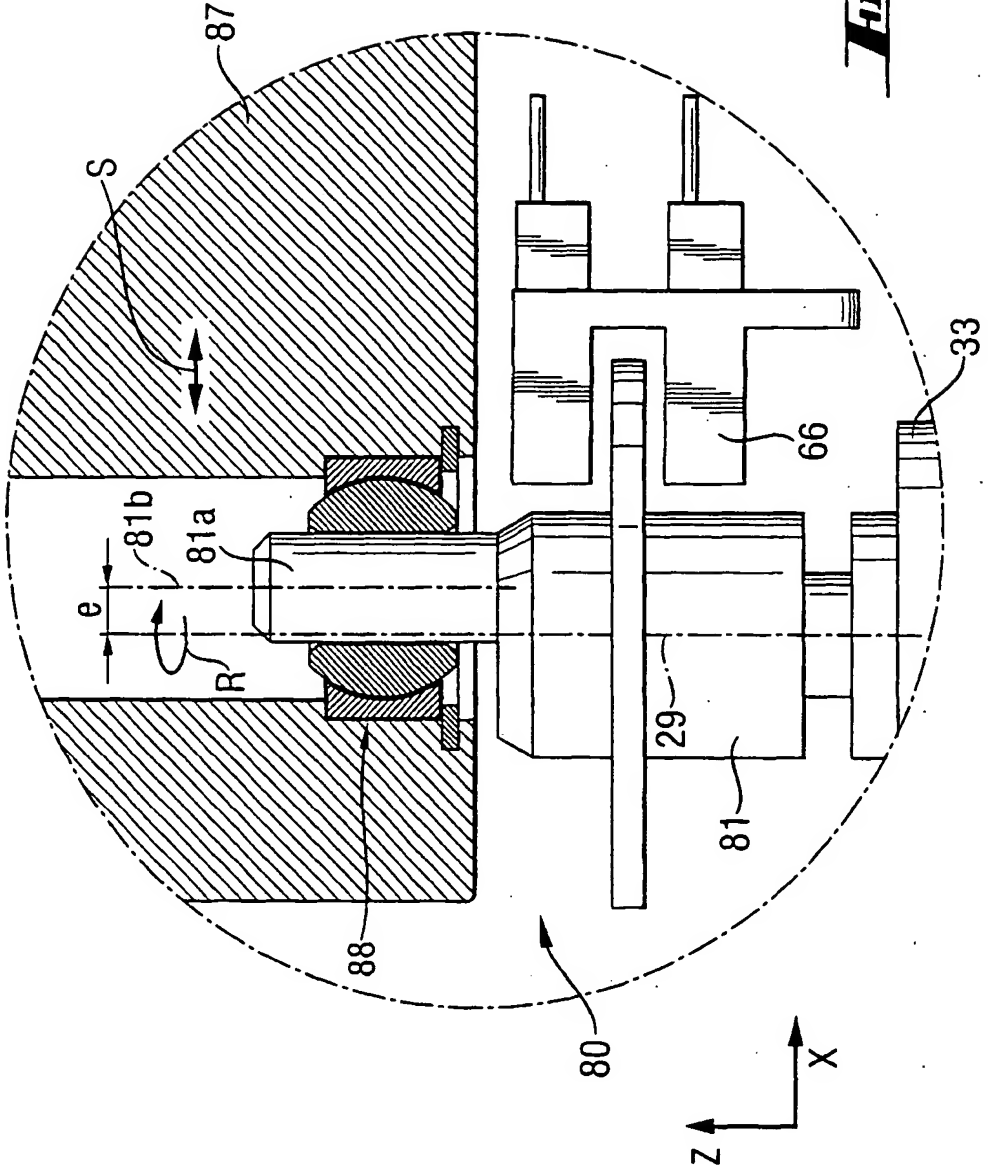


Fig. 14

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 07 8041

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 98/57739 A (CHEMSPEED LTD; GUELLER, ROLF; MUNCH, SERAPHIN; GEES, THOMAS; TSCHIRKY,) 23 December 1998 (1998-12-23) * page 16, line 24 - page 18, line 25 * * page 28, line 27 - page 29, line 5 * * figures 1-6,29 *	1-12	B01L9/06 G01N35/04
A	WO 01/28680 A (GENTRA SYSTEMS, INC) 26 April 2001 (2001-04-26) * page 5 - page 6 * * figures 1,2 *	1-12	
A	US 5 632 388 A (MORRISON ET AL) 27 May 1997 (1997-05-27) * figures 1-3 *	1-12	
A	US 5 665 309 A (CHAMPSEIX ET AL) 9 September 1997 (1997-09-09) * the whole document *	1-12	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B01L
G01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 April 2005	Timonen, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 07 8041

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-04-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9857739 A	23-12-1998	AU 7518598 A	04-01-1999
		AU 7518698 A	04-01-1999
		AU 7518798 A	04-01-1999
		CA 2294296 A1	23-12-1998
		CA 2294941 A1	23-12-1998
		CA 2295048 A1	23-12-1998
		WO 9857738 A1	23-12-1998
		WO 9857739 A1	23-12-1998
		WO 9857740 A1	23-12-1998
		DE 59800276 D1	26-10-2000
		DE 59802843 D1	28-02-2002
		DE 59802844 D1	28-02-2002
		EP 0989907 A1	05-04-2000
		EP 0991464 A1	12-04-2000
		EP 0973607 A1	26-01-2000
		JP 2002504018 T	05-02-2002
		JP 2002507931 T	12-03-2002
		JP 2002504019 T	05-02-2002
		US 6605256 B1	12-08-2003
		AU 9733398 A	31-05-1999
		CA 2308414 A1	20-05-1999
		WO 9924160 A1	20-05-1999
		DE 59802862 D1	28-02-2002
		EP 1027148 A1	16-08-2000
		JP 2001522714 T	20-11-2001
		US 6558632 B1	06-05-2003
WO 0128680 A	26-04-2001	AU 770402 B2	19-02-2004
		AU 1087601 A	30-04-2001
		AU 2004202359 A1	24-06-2004
		CA 2387500 A1	26-04-2001
		EP 1227886 A2	07-08-2002
		JP 2003515103 T	22-04-2003
		US 2002073647 A1	20-06-2002
		WO 0128680 A2	26-04-2001
		US 2002048810 A1	25-04-2002
		US 2004092731 A1	13-05-2004
US 5632388 A	27-05-1997	NONE	
US 5665309 A	09-09-1997	FR 2730315 A1	09-08-1996
		BR 9600549 A	30-12-1997
		DE 69621361 D1	04-07-2002
		DE 69621361 T2	02-01-2003
		EP 0726453 A1	14-08-1996
		ES 2175045 T3	16-11-2002

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 07 8041

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-04-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5665309 A		HU 9600204 A2	28-07-1997
		JP 8248036 A	27-09-1996

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82